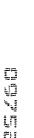
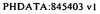


We claim:

- 1. A method for designing a filter for multiple access communications system which minimizes crosstalk between channels comprising the step of identifying signals having a property by which the autocorrelation function associated with said signals decay rapidly from the central lobe, that is, at a higher than 1/x rate which is typical of a wavelength division multiplexing communications system.
 - 2. A method of designing a filter for a multiple access communications system which minimizes crosstalk between channels comprising the step of identifying signals s2(t) having a first property by which the autocorrelation function associated with said s2(t) signals decay rapidly from the central lobe, that is, at a higher than 1/x rate which is typical of a wavelength division multiplexing communications system and having a second property in which the zero points of the autocorrelations function have high order multiplicities.
 - 3. The method of claim 2 further comprising the steps of:
 - (a) choosing a signal s(t) which is periodically orthogonal to its translates;
 - (b) determining a first autocorrelation function associated with s(t);
 - (c) denoting the Fourier transform of s(t) to be S(f);
 - (d) denoting the Fourier transform of said first autocorrelation function of s(t) (as H(f);
 - (e) determining said Fourier transform, H(f), of said first autocorrelation function of s(t) in accordance with the equation H(f) = $|S(f)|^2$;
 - (f) forming the Fourier transform of a second autocorrelation function by convolving H(f) with itself;
 - (g) determining said convolution according to the equationG(f) = Conv(H(f), H(f));
 - (h) determining the square root of G(f);
 - (i) denoting said square root of G(f) as S2(f); and
 - (j) taking the inverse Fourier transform of S2(f).





- 4. The method of claim 2 wherein s(t) is a sinc function.
- 5. The method of claim 2 wherein s(t) is a signal whose autocorrelation function is a Goifman Meyer window.
- 6. The method of claim 2 wherein s(t) is selected from any variety of wavelets at any individual scale.
- 7. The method of claim 2 wherein s(t) is any function whose translates are periodically orthogonal to s(t).
- 8. A method of filtering a signal of a communications system which minimizes crosstalk between channels comprising the steps of:
 - (a) creating a signal from a source of modulated pulses;
- (b) filtering said signal of modulated pulses with a filter designed in accordance with the method specified in claim 2;
- (c) coupling said filtered modulated pulses onto the transmission channel for said communication system;
- (d) receiving said coupled filtered modulated pulses from said transmission channel with a matched filter designed in accordance with the method specified in 3

[∠]claim 2:

- (e) detecting said signal from said matched filter.
- 9. The method of claim 8 wherein said source of modulated pulses produces signals which are relatively stable in time.
- 10. The method of claim 8 wherein said source of modulated pulses produces signals which have known variants.
 - 11. The method of claim 8 wherein said filter is a fiber optic filter.
 - 12. The method of claim 8 wherein said filter comprises in-fiber gratings.
 - 13. The method of claim 8 wherein said filter comprises Bragg gratings.
 - 14. The method of claim 8 wherein said filter comprises thin film filters.
- 15. The method of claim 8 wherein said filter comprises spatial light modulation filters.
- 16. The method of claim 8 wherein said matched filter searches for said signal that was originally transmitted.
 - 17. The method of claim 8 wherein said filter is specifically designed for



- 18. The method of claim 8 wherein said matched filter is specifically designed for said signal.
- 19 A method of filtering a signal of a communications system which minimizes crosstalk between channels comprising the steps of:
 - (a) creating a signal from a source of modulated pulses;
- (b) filtering said signal of modulated pulses with a filter designed in accordance with the method specified in claim 6;
- (c) coupling said filtered modulated pulses onto the transmission channel for said communication system;
- (d) receiving said coupled filtered modulated pulses from said transmission channel with a matched filter designed in accordance with a method for designing a filter for multiple access communications system which minimizes crosstalk between channels comprising the step of identifying signals having a property by which the autocorrelation function associated with said signals decay rapidly from the central lobe, that is, at a higher than 1/x rate which is typical of a wavelength division multiplexing communications system.
 - (e) detecting said signal from said matched filter.
- 20. The method of claim 19 wherein said source of modulated pulses produces signals which are relatively stable in time.
- 21. The method of claim 19 wherein said source of modulated pulses produces signals which have known variants.
 - 22. The method of claim 19 wherein said filter is a fiber optic filter.
- 23. The method of claim 19 wherein said filter comprises in-fiber gratings.
 - 24. The method of claim 19 wherein said filter comprises Bragg gratings.
 - 25. The method of claim 19 wherein said filter comprises thin film filters.
- 26. The method of claim 19 wherein said filter comprises spatial light modulation filters.
- 27. The method of claim 19 wherein said matched filter searches for said signal that was originally transmitted.
 - 28. The method of claim 19 wherein said filter is specifically designed for

said signals.

29. The method of claim 19 wherein said matched filter is specifically designed for said signal.

_____ 30. An electromagnetic matched filter based multiple access system for a communications system which minimizes crosstalk between channels comprising :

- (a) a source of modulated pulses from a digital data stream;
- (b) a first filter for shaping the modulated pulse into a desired pulse for transmission across the communication medium;
 - (c) a transmission medium which is accurately modeled;
- (d) a second filter which is matched to the pulse which exits the communications medium; and
- (e) a detector which converts the modulated pulse stream into the original digital data stream.
- 31. The electromagnetic matched filter based multiple access system of claim 30 wherein said first and second filters are identical.
- 32. The electromagnetic matched filter based multiple access system of claim 30 wherein said first filter is designed in accordance with a method comprising the step of identifying signals s2(t) having a first property by which the autocorrelation function associated with said s2(t) signals decay rapidly from the central lobe, that is, at a higher than 1/x rate which is typical of a wavelength division multiplexing communications system and having a second property in which the zero points of the autocorrelations function have high order multiplicities.
- 33. The electromagnetic matched filter based multiple access system of claim 32 wherein s(t) is any function whose translates are periodically orthogonal to s(t).
- 34. The electromagnetic matched filter based multiple access system of claim 30 wherein said second filter is designed in accordance with a method comprising the step of identifying signals s2(t) having a first property by which the autocorrelation function associated with said s2(t) signals decay rapidly from

the central lobe, that is, at a higher than 1/x rate which is typical of a wavelength division multiplexing communications system and having a second property in which the zero points of the autocorrelations function have high order multiplicities.

- 35. The electromagnetic matched filter based multiple access system of claim 34 wherein s(t) is any function whose translates are periodically orthogonal to s(t).
- 36. The electromagnetic matched filter based multiple access system of claim 30 wherein said first filter is designed in accordance with a method comprising the steps of:
- (a) choosing a signal s(t) which is periodically orthogonal to its translates;
 - (b) determining a first autocorrelation function associated with s(t);
 - (c) denoting the Fourier transform of s(t) to be S(f);
 - (d) denoting the Fourier transform of said first autocorrelation

function of s(t)

as H(f);

- (e) determining said Fourier transform, H(f), of said first autocorrelation function of s(t) in accordance with the equation $H(f) = |S(f)|^2$;
- f) forming the Fourier transform of a second autocorrelation function by convolving H(f) with itself;
- (g) determining said convolution according to the equation G(f) = Conv(H(f), H(f));
 - (h) determining the square root of G(f);
 - (i) denoting said square root of G(f) as S2(f); and
 - (j) taking the inverse Fourier transform of S2(f).
- 37. The electromagnetic matched filter based multiple access system of claim 30 wherein said first filter is designed in accordance with a method comprising the steps of:
 - (a) creating a signal from a source of modulated pulses;
- (b) filtering said signal of modulated pulses with a filter designed in accordance with the method specified in claim 2;

(c) coupling said filtered modulated pulses onto the transmission channel for said communication system;

(d) receiving said coupled filtered modulated pulses from said transmission channel with a matched filter designed in accordance with the method specified in

Claim 2;

(e) detecting said signal from said matched filter.